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ABSTRACT

Objectives It is unclear why the use of email consultation is not more widespread in Dutch general practice, particularly because, since 2006, its costs can be reimbursed. To encourage further implementation, it is needed to understand the current use of email consultations. This study aims to understand the use of email consultation by different patient groups, compared with other general practice (GP) consultations.

Setting For this retrospective observational study, we used Dutch routine electronic health record data obtained from NIVEL Primary Care Database for the years 2010 and 2014.

Participants 200 general practices were included in 2010 (734 122 registered patients) and 434 in 2014 (1 630 386 registered patients).

Primary outcome measures The number and percentage of email consultations and patient characteristics (age, gender, neighbourhood socioeconomic status and diagnoses) of email consultation users were investigated and compared with those who had a telephone or face-to-face consultation. General practice characteristics were also taken into account.

Results 32.0% of the Dutch general practices had at least one email consultation in 2010, rising to 52.8% in 2014. In 2014, only 0.7% of the GP consultations were by email (the others comprised home visits, telephone and face-to-face consultations). Its use highly varied among general practices. Most email consultations were done for psychological (14.7%); endocrine, metabolic and nutritional (10.9%); and circulatory (10.7%) problems. These diagnosis categories appeared less frequently in telephone and face-to-face consultations. Patients who had an email consultation were older than patients who had a telephone or face-to-face consultation. In contrast, patients with diabetes who had an email consultation were younger.

Conclusion Even though email consultation was done in half the general practices in the Netherlands in 2014, the actual use of it is extremely low. Patients who had an email consultation differ from those who had a telephone or face-to-face consultation. In addition, the use of email consultation by patients is dependent on its provision by GPs.

Strengths and limitations of this study

- In this study, we used routine electronic health record data obtained from a large nationwide database, comprising general practice data that are representative for the Dutch population (including 734 122 registered patients in 2010 and 1 630 386 in 2014).
- The focus of this study is on the use of email consultation in primary care, which is one of the first eHealth services provided in primary care, and its costs can already be reimbursed since 2006 in the Netherlands.
- In this study, we investigated registered general practitioner consultations. The observation that several general practices registered no email consultations does not indicate whether these general practices actually offered a service to perform email consultations; it could be that they offered it but did not use or register email consultations.
- In this study, data of 2010 and 2014 were used; more recent data might show higher email consultation rates.

INTRODUCTION

In the past decade, interest has grown in digital services for communication in primary care between patients and healthcare professionals.[1–3] In several European countries, between 19% (UK) and 51% (Denmark) of patients sent or received an email from their doctor, nurse or healthcare organisation.[1] Email consultation is an asynchronous way of communication by which patients can consult their healthcare professional at any time of the day, and healthcare professionals can respond when it is suitable for them. Email consultations are consistent with the trend in primary care towards care processes being performed more efficiently, by shifting tasks from the general practitioner to the primary care nurse.[4 5] However, in many

countries, the use of email consultation is not yet structurally embedded in daily care routines and is often not yet encouraged by national policies.[6]

Numerous studies have been conducted to investigate the concerns and benefits regarding email consultation. Identified concerns include an increase in the workload of physicians,[7–9] privacy and safety issues[9 10] and the exacerbation of existing inequalities in access to healthcare.[7 9] In contrast, other studies found that email consultation is time-saving[11 12] and that it can offer increased opportunities for marginalised groups to access healthcare.[13] In addition, it is expected that, by the introduction of email consultation, general practice consultations can be reduced, particularly telephone consultations; however, studies have shown inconsistent effects regarding this suggested reduction.[14] In general, evidence is still inconclusive regarding the impact of email consultations.[15]

Studies examining the consulting pattern of patient groups using email consultation, in comparison with office consultations, are scarce.[1] The few studies that have investigated the characteristics of frequent email consultation users have shown mixed results; some found that email consultation was used more by the younger[1 16 17] and higher educated groups,[1] while others found that age[3] and employment status[16] did not seem to influence its use. In addition, little is known about the health issues about which patients communicate using email. It seems that patients use email to pose questions about biomedical concerns, medication and test results and to inform or update healthcare professionals about non-urgent health issues ('for your information' messages).[3 18] For further implementation, insight is needed to clearly understand the feasibility and acceptability of email consultation by different patient populations and to compare these with other GP consultations.[6]

In contrast to many other countries, since 2006, the costs of email consultation in primary care can be reimbursed by the health insurance in the Netherlands. The Dutch Ministry of Health, Welfare and Sport acknowledges the potential benefits of eHealth and stimulate the use of online communication in healthcare.[19] In addition, the Dutch College of General Practitioners set up guidelines for the use of email consultation and stimulates the use of it.[20] Nevertheless, the actual use of email consultation seems low.[2] In addition, the effectiveness of email consultation and the benefits it can bring are unclear. Understanding for which patients, and for what reasons, email is currently used might be important to maximise the benefits it can bring.[9]

This study aims to acquire insights into the current status of email consultation usage in the Netherlands, by using data from electronic health records of Dutch primary care practices. In particular, the focus is on the number of email consultations done by different patient groups (in terms of age, gender, socioeconomic status and health conditions) as registered by primary care professionals. First, the email consultation rates in the Netherlands in 2010 and 2014 will be investigated. Second, it will be investigated which patients (age, gender and socioeconomic status) had an email consultation and for what health problems; these characteristics will be compared with those who had telephone or face-to-face consultations in 2014. Third, for the patient group who had the most email consultations (as percentage of all GP consultations in that group), characteristics will be investigated together with the impact of email consultation (in terms of its percentage of use in comparison with telephone and face-to-face consultations) within this patient group. Because the use of email consultation by patients might be dependent on its provision by the general practice, the general practice characteristics will also be taken into account.

METHODS

Design, participants and care setting

We used routine electronic health record data from general practices, collected by NIVEL Primary Care Database[21] in 2010 and 2014. Representative data of 200 general practices in 2010 and 434 general practices in 2014 were used, representing on average 734 122 and 1 630 386 inhabitants, respectively (4.4% and 9.7% of the Dutch population). We used only data from practices that met certain criteria regarding data quality; only general practices were included that recorded more than 70% of their consultations with International Classification of Primary Care (ICPC) codes and provided data for the entire calendar year. Primary care practices voluntarily participate in NIVEL Primary Care Database.

All Dutch residents are registered in one general practice. Health insurance is mandatory, in which GP consultations are fully covered. The GP is the gatekeeper for hospital and specialist care. Since 2006, an email consultation can be reimbursed: (1) when it is done by a patient who is registered at the general practice, (2) in the case of an existing treatment relationship, (3) when it is not the first consultation for a health condition and (4) when it is a substitute for a regular consultation.[22]

Measurements

Characteristics of general practices

The following general practice characteristics were included: average number of registered patients per general practice and level of urbanisation (from 1 being highly urban to 5 being not urban).

General practice consultation

To compare the utilisation rate of email consultation with other GP consultations, the following were included: email consultations, short face-to-face consultations (20 min or less), long face-to-face consultations (more than 20 min), short home visits (less than 20 min), long home visits (more than 20 min) and telephone consultations (consultation types according to reimbursement codes determined by the Dutch Healthcare Authority[23]).

To investigate and compare the patient characteristics of those who had an email consultation with those who underwent another type of GP consultation, only email consultations, telephone consultations and face-to-face consultations (short+long) were included. For every consultation, the date and diagnosis were included. Consultations and corresponding diagnoses were coded according to the ICPC-1.[24] Only consultations with a single ICPC were included in the analyses.

Patient characteristics

Age and gender were included as patient characteristics. In addition, neighbourhood status scores were provided by the Netherlands Institute for Social Research at postal code level (PC4). This score reflects the socioeconomic status score of a neighbourhood, compared with other neighbourhoods in the Netherlands,[25] and is a common indicator of neighbourhood socioeconomic status (NSES) in the Netherlands.[26] The socioeconomic status scores were assessed in 2010 and 2014 and comprised four indicators: the average household income per particular postal code, the proportion of residents with low family income, the proportion of low-educated residents and the proportion of unemployed residents per postal code. A higher score means a higher status for the area of residence. Scores ranged from −6.75 to 3.06. The average NSES in the Netherlands is 0.0.

Statistical analyses

Three data sets were used for this study. First, to investigate the consultation rates in 2010 and 2014, all general practices in these years (from our dataset) were included, and the following consultation types were analysed: email consultation, face-to-face consultation, long face-to-face consultation, home visits, long home visits and telephone consultation. Descriptive analyses were conducted to calculate the consultation rate per 1000 registered patients (counted from the average number of registered patients per year) in 2010 and 2014 and to count the general practices that registered email consultations in these years.

Second, to investigate which patient groups had email consultations, and for what health problems, and to compare this with patients who had another GP consultation, only data from general practices in 2014 were used. The following consultation types were analysed: email consultation, face-to-face consultation (short and long) and telephone consultation. Patients and consultations with incomplete datasets were excluded. This included observations with missing patient characteristics or consultations with none or two or more ICPC codes. A percentage of 31.6 of the observations were excluded, of which 28.6% was due to consultations with none or two or more ICPCs. Because the use of email consultation by patients is dependent on its provision by the general practice, the dataset was split into three groups based on the number of email consultations that general practices had in 2014: (1) general practices that did not register any email consultation, (2) general practices that registered a few email consultations (n<100) and (3) general practices that registered many email consultations (n≥100). Descriptive analyses were used to investigate general practice characteristics (the average number of registered patients per general practice and level of urbanisation) and patient characteristics (age, gender and NSES). The diagnosis categories for which email consultations, telephone consultations and face-to-face consultations (short+long) were done were calculated using descriptive analyses.

Every diagnosis category consisted of specific diagnoses. In the third dataset, we included the patient group in which email consultations, as percentage of all GP consultations in that group, were most often used. The following consultation types were analysed: email consultation, face-to-face consultation (short+long) and telephone consultation. This dataset was split into three, based on the number of email consultations that general practices registered for that specific diagnosis in 2014: (1) general practices that did not register any email consultation for that diagnosis, (2) general practices that registered a few email consultations for that diagnosis (n<25) and (3) general practices that registered many email consultations for that diagnosis (n≥25). Descriptive analyses were used to investigate general practice characteristics (the average number of registered patients per general practice and level of urbanisation) and patient characteristics (age, gender and NSES).

To identify significant differences of general practice characteristics between the three groups of practices, two-way analysis of variance with Bonferroni correction (average number of registered patients, mean age and NSES of the general practice patient population and level of urbanisation per general practice) were conducted. Differences in patient characteristics within the three groups of general practices (patients who had an email, telephone or face-to-face consultation) were not tested for statistical significance because of the large sample size. In large samples, small differences can be detected as significant, even though they are not practically relevant. Therefore, only relevant differences are reported. The statistical package STATA (V.14.0) was used to conduct the analyses.

RESULTS

Study population

Dataset 1

In 2010, data from 200 general practices were used, including 2 708 191 general practice consultations (577 487 patients). The mean age of the study population was 41.7 (SD=23.1, missing data n=4207), 45.5% male and the mean NSES was −0.10 (SD=1.19, missing data n=93 193). In 2014, data from 434 general practices were collected including 6 473 921 general practice consultations (1 307 822 patients). The mean age of the study population was 43.1 (SD=23.4, missing data n=9 298), 45.7%

Table 1 Characteristics of general practices in 2010 and 2014

General practice characteristics	2010 Mean (SD) or n (%)	2014 Mean (SD) or n (%)
General practices (n)	200	434
Registered patients (n)	734 122	1 630 386
General practice consultations (n)	2 708 191	6 473 921
Patients who had a general practice consultation (n)	577 487	1 307 822
Average number of registered patients per general practice	3671 (SD=2501)	3757 (SD=2384)
Level of urbanisation (n (%))		
Very urban	40 (20.0)	89 (20.5)
High	46 (23.0)	99 (22.8)
Moderate	38 (19.0)	84 (19.4)
Little	42 (21.0)	85 (19.6)
Not urban	32 (16.0)	75 (17.3)
Missing	2 (1.0)	2 (0.5)
General practices that registered email consultations (n (%))	64 (32.0)	229 (52.8)

male (missing data n=98) and the mean NSES was 0.08 (SD=1.10, missing data n=28 209). The characteristics of these general practices can be found in table 1.

Dataset 2

In dataset 2, data from 2014 were used. Home visits, and patients and consultations with incomplete data were excluded. Four hundred and twenty-nine general practices were included. Non-response analyses showed no differences after exclusion (compared with the complete dataset without home visits) regarding patient characteristics (age, gender and NSES) and general practice characteristics (average number of registered patients per general practice and level of urbanisation). Characteristics of the general practices in the total dataset 2, and of the general practices that registered none, a few (<100) and many (≥100) email consultations can be found in online supplementary file 1.

Examination of the differences in general practice characteristics between these three groups showed differences in number of registered patients per general practice (F=7.11, P<0.01), level of urbanisation (F=11.81, P<0.01) and age (F=4.40, P=0.01). General practices that registered email consultations had a higher number of registered patients per general practice, were located in more urban areas and had a younger patient population. No significant difference of NSES was found between these three groups (F=1.94, P=0.14).

Dataset 1: the use of email consultation in 2010 and 2014

The number of general practices that used email consultation increased from 32.0% in 2010 to 52.8% in 2014. The consultation rates per consultation type for 2010 and 2014 can be found in table 2. The utilisation of email consultation increased from 8.4 per 1000 registered patients in 2010 to 17.6 in 2014. In comparison, 1033.9 telephone consultations per 1000 registered patients were carried out in 2010 and 1140.6 in 2014. In general practices that registered email consultations, 0.6% (n=5494) of the total GP consultations were by email in 2010; in 2014, this was 0.7% (n=24 556).

For 2014, the consultation rate per consultation type was calculated for general practices that did not register any email consultations, that registered a few email consultations (n<100) and that registered many email consultations (n≥100). In general practices that registered many email consultations, the utilisation of email consultations was 95.8 per 1000 registered patients.

Dataset 2: characteristics of email, telephone and face-to-face consultation users

Table 3 shows the characteristics of patients who had at least one email, telephone or face-to-face consultation, distributed in terms of general practices that performed none, a few or many email consultations. In general practices that had a few email consultations, 0.6% of the patients who had at least one GP consultation had

Table 2 Consultation rate per 1000 registered patients per year

Year	General practices	n	Email	Face-to-face	Face-to-face long	Home visit	Home visit long	Telephone
2010	All general practices	200	8.4	2325.0	374.6	147.4	73.3	1033.9
2014	All general practices	434	17.6	2299.6	532.6	128.9	89.2	1140.6
2014	General practices that did not register email consultations	205	–	2241.3	510.8	145.0	94.5	1058.6
2014	General practices that registered <100 email consultations	163	8.1	2404.2	563.2	120.4	89.2	1176.3
2014	General practices that registered ≥100 email consultations	66	95.8	2222.2	524.9	99.7	72.5	1307.3

Table 3 Characteristics of patients who had an email, telephone or face-to-face consultation in general practices that registered none, a few (n<100) and many (n≥100) email consultations

	General practices that did not register any email consultation (n=211)		General practices that registered a few (n<100) email consultations (n=175)			General practices that registered many (n≥100) email consultations (n=43)		
Patient characteristics	Telephone n patients= 255 153	Face-to-face (short+long) n patients= 466 672	Email n patients= 3214	Telephone n patients= 275 352	Face-to-face (short+long) n patients= 441 424	Email n patients= 7 225	Telephone n patients= 81 221	Face-to-face (short+long) n patients= 133 427
	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)
Age	47.3 (SD=23.7)	43.6 (SD=23.4)	46.4 (SD=20.8)	45.7 (SD=23.5)	42.0 (SD=23.4)	46.4 (SD=19.9)	45.2 (SD=23.3)	42.1 (SD=22.9)
Gender (% male)	103 117 (40.4)	212 399 (45.5)	1 355 (42.2)	110 337 (40.1)	198 051 (44.9)	3 055 (42.3)	32 288 (39.8)	59 850 (44.9)
NSES	0.02 (SD=1.02)	0.02 (SD=1.02)	0.22 (SD=1.07)	0.06 (SD=1.18)	0.05 (SD=1.19)	0.36 (SD=0.97)	0.35 (SD=0.97)	0.38 (SD=0.97)

NSES, neighbourhood socioeconomic status.

an email consultation. This was 4.8% in general practices that had many email consultations.

In general practices that registered email consultations, relevant differences were found in age between patients who had an email versus a telephone or face-to-face consultation; patients who had an email consultation seemed to be older. In general practices that registered a few email consultations, the mean age of patients that did an email consultation was 46.4. This was 45.7 and 42.0 for patients that did a telephone and face-to-face consultation, respectively. In general practices that registered many email consultations, the mean age of patients that did an email consultation was 46.4. This was 45.2 and 42.1 for patients who did a telephone and face-to-face consultation, respectively.

Dataset 2: diagnosis categories of email consultations versus telephone and face-to-face consultations

The diagnosis categories for which patients had an email, telephone or face-to-face consultation in 2014 can be found in table 4 (listed from the most to the least frequently used diagnosis category). Most email consultations were associated with the following diagnosis categories: psychological (14.7%); endocrine, metabolic and nutritional (10.9%); and circulatory (10.7%). In comparison with other GP consultations, these diagnosis categories were less frequently associated with telephone consultations (psychological: 9.1%; endocrine, metabolic and nutritional: 7.3%; and circulatory: 8.2%) and face-to-face consultations (psychological: 5.8%; endocrine, metabolic and nutritional: 4.4%; and circulatory: 9.1%).

Considering specific diagnoses, the highest number of email consultations were done for hypertension (5.3%, n=873 consultations), diabetes (5.0%, n=835 consultations) and depression (2.5%, n=409 consultations). This involved 1.8% (diabetes), 1.6% (depression) and 1.0% (hypertension) within the total number of GP consultations for diabetes, depression and hypertension, respectively, in general practices that registered email consultations.

Dataset 3: email consultations for diabetes

As described in the previous paragraph, the highest percentage of email consultations was performed within diabetes consultations (1.8% of all GP consultations for diabetes). Therefore, in-depth analyses were carried out for this diagnosis group.

In 2014, 37 409 patients had at least one GP consultation for diabetes (80 867 GP consultations). The mean age of the study population was 66.4 (SD=13.7), 51.5% male and the mean NSES was −0.15 (SD=1.14). Characteristics of the general practices in the total dataset 3, and of the general practices that registered none, a few (<25) and many (≥25) email consultations for diabetes, can be found in online supplementary file 2. Examination of the differences in general practice characteristics between these three groups showed differences in number of registered patients per general practice (F=17.44, P<0.01) and level of urbanisation (F=5.72, P<0.01). General practices that registered email consultations for diabetes had a significantly higher average number of registered patients and were located in more urban areas. No significant difference was found in mean age (F=1.17, P=0.31) and NSES (F=1.99, P=0.14).

Dataset 3: characteristics of patients with diabetes who had a consult by email, telephone or face-to-face

Characteristics of patients who had a diabetes consultation with their general practitioner by email, telephone or face-to-face in general practices that registered none, a few or many email consultations can be found in table 5.

In general practices that registered email consultations for diabetes, relevant differences were found in age of patients with diabetes who had an email consultation versus a telephone and face-to-face consultation; patients that had an email consultation seemed to be younger.

In general practices that registered many email consultations for diabetes, 12.5% (n=233) of the patients with diabetes had at least one email consultation, and in general practices that registered a few email consultations for diabetes, this was 1.8% (n=132). In addition, in general practices that registered many email consultations

Table 4 Diagnosis categories associated with email, telephone or face-to-face consultations in general practices that registered at least one email consultation in 2014 (n general practices=218), listed from the most to the least frequently used diagnosis category

	Email consultations n consultations=16 558		Telephone consultations n consultations=770 103		Face-to-face consultations (short+long) n consultations=1 609 157	
	Diagnosis category	n (%)	Diagnosis category	n (%)	Diagnosis category	n (%)
1	Psychological	2434 (14.7)	Musculoskeletal	109 115 (14.2)	Skin	259 034 (16.1)
2	Endocrine, metabolic and nutritional	1802 (10.9)	Digestive	75 508 (9.8)	Musculoskeletal	245 441 (15.3)
3	Circulatory	1777 (10.7)	Respiratory	74 819 (9.7)	Respiratory	172 494 (10.7)
4	Musculoskeletal	1609 (9.7)	General /unspecified	70 539 (9.2)	Circulatory	145 828 (9.1)
5	Skin	1428 (8.6)	Psychological	70 297 (9.1)	Digestive	106 511 (6.6)
6	General /unspecified	1423 (8.6u)	Circulatory	62 924 (8.2)	Ear	974 12 (6.1)
7	Respiratory	1274 (7.7)	Skin	56 879 (7.4)	Psychological	93 820 (5.8)
8	Digestive	1213 (7.3)	Endocrine, metabolic and nutritional	55 952 (7.3)	General /unspecified	92 600 (5.8)
9	Female genital	649 (3.9)	Female genital	40 276 (5.2)	Urological	90 444 (5.6)
10	Pregnancy, childbearing and family planning	574 (3.5)	Neurological	24 262 (3.2)	Endocrine, metabolic and nutritional	70 548 (4.4)
11	Neurological	554 (3.4)	Pregnancy, childbearing and family planning	22 347 (2.9)	Female genital	47 670 (3.0)
12	Social problems	380 (2.3)	Eye	17 894 (2.3)	Eye	43 327 (2.7)
13	Urological	367 (2.2)	Blood	13 757 (1.8)	Neurological	42 980 (2.7)
14	Male genital	348 (2.1)	Ear	12 812 (1.7)	Pregnancy, childbearing and family planning	32 618 (2.0)
15	Eye	288 (1.7)	Social problems	12 124 (1.6)	Blood	29 950 (1.9)
16	Blood	242 (1.5)	Male genital	11 648 (1.5)	Male genital	19 839 (1.2)
17	Ear	196 (1.2)	Urological	3 895 (5.1)	Social problems	18 641 (1.2)

for diabetes, 13.8% (n=560) of the GP consultations for diabetes were by email. In comparison, 29.0% (n=1180) of the consultations were by telephone and 57.2% (n=2327) face to face. In general practices that did not register email consultations for diabetes, 40.1% (n=23 722) were telephone and 59.9% (n=35 448) face-to-face consultations.

DISCUSSION

Principal findings

This study aimed to acquire insights into the current status of email consultation usage in the Netherlands, with a focus on the patient perspective. In 2010, 32.0% of the general practices studied used email consultations; this was more than half (52.8%) in 2014. However, in 2014, email consultations comprised still less than 1% of the total number of GP consultations (home visits, face-to-face, telephone and email consultations) in general practices that registered at least one email consultation. Patients who had an email consultation with their GP in 2014 were older compared with patients who had a telephone or face-to-face consultation. Furthermore, in general practices that registered many (≥100) email consultations, almost 5% of the patients who had at least one GP consultation (face-to-face, telephone or email consultation) had an email consultation. Most patients had an email consultation with their GP for issues related to psychological, endocrine, metabolic, nutritional and circulatory health problems. These diagnosis categories seemed to appear less frequently in telephone and face-to-face consultations. The highest percentage of email consultations in comparison with

Table 5 Characteristics of patients who had a general practice consultation by email, telephone or face-to-face for diabetes in general practices that registered none, a few (n<25) or many (n≥25) email consultations for diabetes

	General practices that did not register any email consultations for diabetes (n=351)		General practices that registered a few (n<25) email consultations for diabetes (n=69)			General practices that registered many (n≥25) email consultations for diabetes (n=9)		
Patient characteristics	Telephone n patients= 11 723	Face-to-face (short+long) n patients= 16 674	Email n patients= 132	Telephone n patients= 2992	Face-to-face (short+long) n patients= 4025	Email n patients= 233	Telephone n patients= 516	Face-to-face (short+long) n patients= 1114
	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)
Age	68.0 (SD=14.5)	65.5 (SD=12.9)	62.0 (SD=11.3)	67.8 (SD=14.8)	65.6 (SD=12.9)	61.2 (SD=11.8)	66.2 (SD=14.8)	64.7 (SD=12.5)
Gender (% male)	5 587 (47.7)	9 053 (54.3)	80 (60.6)	1 361 (45.5)	2 142 (53.2)	133 (57.1)	245 (47.5)	662 (59.4)
NSES	−0.17 (SD=1.19)	−0.20 (SD=1.14)	0.11 (SD=1.01)	−0.15 (SD=1.10)	−0.17 (SD=1.06)	0.46 (SD=0.69)	0.42 (SD=0.78)	0.43 (SD=0.71)

NSES, neighbourhood socioeconomic status.

all GP consultations within one specific disorder was related to diabetes. Interestingly, patients with diabetes who had an email consultation were younger. In general practices that registered many (≥25) email consultations for diabetes, 12.5% of the patients with diabetes had at least one email consultation for this condition. Patients' email consultation usage is also dependent on its provision by the general practice: in general practices with a higher number of registered patients, located in more urban areas and with a younger patient population, email consultation was more often used.

Strengths and weaknesses

The main strength of this study is that data were used from a large nationwide database comprising the electronic health records of Dutch general practices. This database is representative for the Dutch (general practice) population.[21] General practices that did not fulfil the criteria for completeness of registration were excluded; however, this caused minimal selection bias. Email consultations are recorded just as any other consultation in the Dutch electronic health record systems and thus are fully integrated. As there are clear financial incentives, we assume that email consultations that fit the claims requirements will be claimed and thus recorded in the electronic health record systems. We assumed that all registered consultations included in this study are actually performed according to the rules of national declaration policy of the Dutch College of General Practitioners[22] and the Dutch Healthcare Authority.[23] However, within the scope of this study, we could not check if this was really the case with all included consultations. Nevertheless, using data from registered consultations of electronic health records seems to be the most representative source for the investigation of actual email consultation usage.

To reduce variation between general practices, we split the dataset into three groups of general practices: those registering none, a few or many email consultations. The observation that general practices registered no email consultations does not indicate whether these general practices actually offered a service to perform email consultations. Although we do not have information about the online services offered in the general practices of our dataset, the annually published eHealth monitor about the status of eHealth in the Netherlands revealed that 49% of the surveyed general practices reported offering email consultation in 2014.[27] In comparison, 52.8% of the general practices in our dataset registered at least one email consultation in 2014.

It might be expected that general practices only offer email consultation for specific diagnoses (eg, due to diagnosis-specific procedures or applications); however, we found that all general practices in our dataset registered email consultations for a wide range of diagnoses, which suggests that it could be used for all kinds of health problems. However, due to requirements for reimbursement of email consultation, it should be noted that not every email consultation can be claimed. In addition, some

health questions cannot be addressed by email. In our analyses, we did not make a distinction between consultations that could be done by email or not, because it is currently unclear what questions are appropriate for this type of consultation. A limitation is that we excluded consultations with none or two or more conditions, due to methodological reasons. However, by redoing the analyses with these consultations included, results did not highly differ.

Another limitation of the study is that socioeconomic status was assessed at district level (postal code area); patients' individual socioeconomic status was unknown. Therefore, NSES cannot be purely seen as an individual characteristic and is dependent on the area where the general practice is located. Furthermore, in this study, data of 2010 and 2014 were used. More recent data would probably show higher email consultation rates. The annual Dutch eHealth monitor reported that the number of general practices that offer email consultations increased from 49% in 2014 to 60% in 2016.[28] Nevertheless, there are no indications that email consultation is used by other patient groups.

Comparison with existing literature

Half of the Dutch general practices in our dataset registered email consultation in 2014; in comparison, it is only offered in 6% of the general practices in the UK[29] but to all citizens in Denmark via a public health portal.[30] Even though it seems that email consultation is offered by half the general practices in the Netherlands, its actual use is extremely low. This is not the case in Denmark, where, in 2013, more than 4 million GP email consultations were done (in comparison with about 20 million face-to-face consultations),[31 32] and a questionnaire study (n=684) showed that 52% of the respondents (or their closest relative) had used an email consultation.[31]

The lack of reimbursement is frequently mentioned as reason why eHealth is not yet fully adopted in primary care. A recently conducted systematic review of the factors influencing the implementation of eHealth found that cost-related factors were mentioned by most studies as important barriers for the implementation of eHealth.[33] However, our study shows that funding for eHealth does not directly guarantee eHealth use.

Overall, patients that had an email consultation were older. Studies have found that a younger age is associated with email consultation usage.[1 16] This is not found when analysing the entire patient population; however, looking into the diagnosis group that had the most email consultations (patients with diabetes), we found that email consultation users seemed to be younger, compared with patients of this diagnose group who had a telephone or face-to-face consultation with their GP. It should be noted that email consultations in the Netherlands can only be reimbursed when it is not the first consultation for a health condition; this might explain the observation that, overall, patients who had an email consultation were older, as the number of people with a prolonged or chronic disease was greater in the higher age groups.

This study focuses on the consulting pattern of patient groups using email consultation, in comparison with other GP consultations. The use of email consultation by patients, however, highly varies among general practices. Patients' email consultation usage seems therefore partly dependent on its provision by the general practice. Therefore, the patient perspective cannot be studied in isolation; it is probably dependent on how general practices offer, promote and use it.[34 35]

Interestingly, email consultations were most frequently used for diagnoses related to psychological (14.7%); endocrine, metabolic and nutritional (10.9%); and circulatory (10.7%) concerns, which were less frequently the topic of telephone and face-to-face consultations. In the scarce research that have been performed regarding the content of online consultations, it was found that, using an online patient-provider portal, more psychosocial messages were sent via the portal than by telephone.[36] In addition, a review of the impact of digital communication on marginalised groups suggests that online communication may reduce patients' inhibitions and sense of intimidation, resulting in more disclosure and asking of questions.[13] Moreover, a study of electronic health records with the possibility of exchanging secure messages showed that this was most frequently used by patients with a chronic condition.[37] In the current study, email consultation was most used by patients with diabetes. It seems that this disease is highly convenient for the use of email consultation, because of the prolonged characteristic of the disease and the frequency of contact with the GP. The latter might suggest that these patients have a well-established and trusting relationship with their GP, which is found to be related to successful digital communication among patients and care professionals.[13] In addition, it has been noted that patients use email to report a change in their condition or to discuss laboratory results, new conditions, changes in prescription dose, the need for new prescriptions or other requests for actions regarding medications or treatments[37–39] ; all of these are frequently seen in diabetes management. In our study, we did not have information about the content of the email consultations, only the type of diagnosis. This should be further investigated in future research.

Implications for research and practice

Email consultation has the potential to become a routinely used communication service for patient–GP interaction, similarly to telephone consultations; it seems to be an appropriate service in this day and age, when digital communication plays an important part in many individuals' daily lives. However, this study has shown that, in the Netherlands, the actual use of email consultation is extremely low.

It seems that email consultation is not just a service that can be merely installed. Without clear implementation strategies, including promotion strategies and

defining for which patients it can be best used, it might not be adopted by patients. In this study, we found that email consultation is most used by people with psychological, endocrine or circulatory concerns. Focusing on these target groups first, and investigating the effectiveness of email consultation and the benefits it can bring for these patient groups, might be important to stimulate broader uptake among GPs and patients. In addition, investigating reasons why patients do not use email consultation might provide important insights about patients' views regarding email consultation and the barriers that need to be overcome. Experiencing the benefits of the use of email consultation can be the drive for its routine use, for both patients and care professionals. Moreover, the use of email consultation by patients highly varies among general practices. It is recommended to qualitatively study the use of email consultation in general practices that use many email consultations and in general practices that offer it but use it less frequently. Investigating why it works in 'good practices' and why it is less frequently used in others will give more insight in the process that is needed to successfully implement and use email consultation. These studies should be focused on the two-layered issue, from both perspectives of patients and providers.

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Patient consent Not required.

Ethics approval The Dutch law allows the use of electronic health records for research purposes under certain conditions. According to this legislation, neither obtaining informed consent from patients nor approval by a medical ethics committee is obligatory for this type of study containing no directly identifiable data (Dutch Civil Law, Article 7:458). This study has been approved according to the governance code of NIVEL Primary Care Database, under number NZR-00315.062.

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